ABSTRACT OF THE DISCLOSURE

A magnetoresistive (MR) sensor can be shaped using ion beam irradiation and/or implantation through a mask introduced between a MR structure and an ion source. The mask covers selected portions of the MR structure to define the track width of the sensor. Ion irradiation and/or implantation reduces the magnetoresistance of the unmasked portions while leaving the masked portion substantially unaltered. The mask can be a photoresist mask, an electron beam resist mask, or a stencil mask. Alternatively the mask may be part of a projection ion beam system. Track width resolution is determined at the mask production step. The edges of the sensor can be defined by a highly collimated ion beam producing an extremely straight transition edge, which reduces sensor noise and improves sensor track width control. Improved hard bias layers that directly abut the sensor may be used to achieve a suitable stability. A variety of longitudinal bias schemes are compatible with ion beam patterning.